EC2x&EG25-G Wi-Fi Application Note

LTE Standard Module Series

Rev. EC2x&EG25-G_Wi-Fi_Application_Note_V1.1

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About the Document

Revision History

Version	Date	Author	Description
1.0	2017-12-20	Duke XIN/ Adolph WANG	Initial
1.1	2020-02-26	Mike ZHOU/ Paddy LI	1. Added AT+QWIFICFG related commands (Chapter 2.10). 2. Added Wi-Fi related URC of AT+QWIFICFG related commands (Chapter 3.2 and 3.3). 3. Added examples for AT+QWIFICFG related commands (Chapter 4).

Contents

Table Index

Figure Index

1 4G+Wi-Fi Solution

1.1. Introduction

The rapid development of LTE and IoT accelerates the integration of 4G and Wi-Fi technology, many customer companies turn to convert the operator's 4G signals to Wi-Fi signals so that smartphone, tablet and laptop users can enjoy free Wi-Fi access to share local resources and communicate with several terminals over a high-speed network.

Therefore, Quectel provides a 4G+Wi-Fi one-stop solution based on its own wireless modules and FC20 Wi-Fi module. This solution is realized through converting 4G signals into Wi-Fi signals to create Wi-Fi hotspots.

This document is applicable to the following Quectel LTE Standard modules:

- EC2x: EC21, EC25, EC20 R2.0 and EC20 R2.1
- EG25-G

NOTE

Currently all supported modules with 128M RAM+128M ROM do not support the 4G+Wi-Fi one-stop solution.

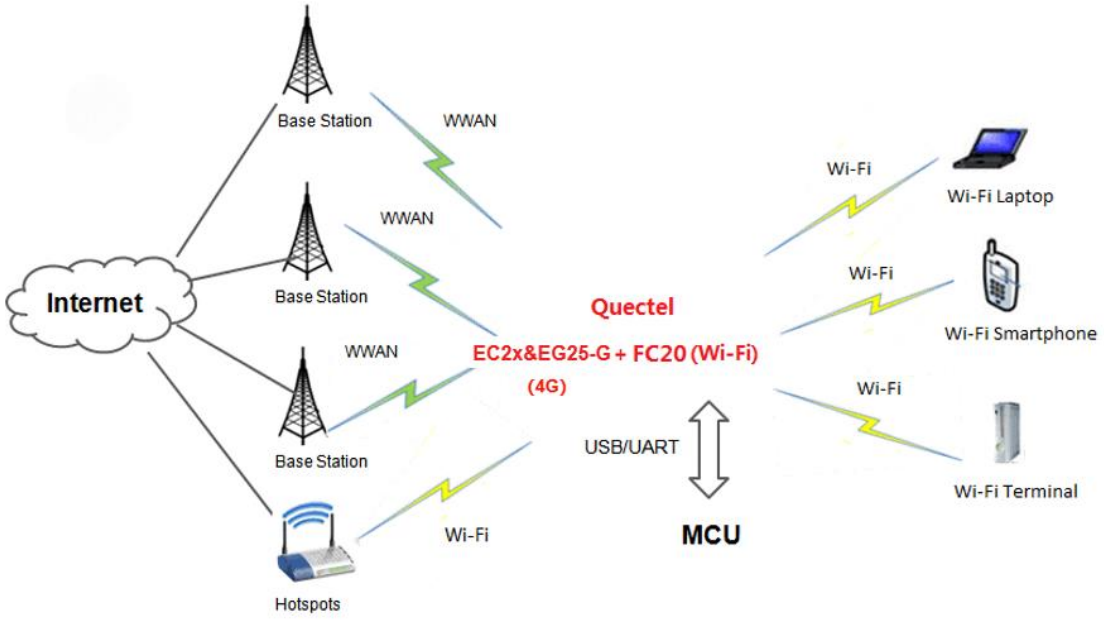

Figure 1: Software Workflow of 4G+Wi-Fi One-stop Solution

1. Client and MCU can access 4G network through EC2x&EG25-G modules at the same time.
2. MCU can control Wi-Fi connection by AT commands.
3. FC20 Wi-Fi module supports AP and STA modes. In AP mode, the client (a mobile phone, computer) connected to the AP hotspot can access the Internet through the cellular network of EC2x&EG25-G modules. In STA mode, the physical interfaces (ECM, RNDIS or SGMII interface) of EC2x&EG25-G modules can access the Internet.
4. EC2x&EG25-G modules support various connections between module and MCU such as connection through USB and UART.
5. The maximum access point is 16.
6. STA mode of Wi-Fi only supports hotspot connection and scanning.

1.2. FC20 Features

Table 1: FC20 Features

Dimensions	(16.6±0.15)mm × (13.0±0.15)mm × (2.1±0.2)mm
Package	LCC
Frequency	2.4GHz WLAN: 2.412GHz~2.472Hz

	5GHz WLAN: 5.180GHz~5.825GHz BT 4.2*: 2.402GHz~2.48GHz
The Number of Pins	62
Supply Voltage	Main: 3.3V IO: 1.8V
WLAN Interface	SDIO 3.0
WLAN Standard	802.11a/b/g/n/ac
Antenna	Wi-Fi/BT antenna
Transmission Data (Maximum)	433Mbps @ 802.11ac 150Mbps @ 802.11n 54Mbps @ 802.11a/g 11Mbps @ 802.11b TBD @ BT 4.2*
AP	Maximally 16
Operation Temperature	-40°C to +85°C

NOTE

"*" means under development.

1.3. Wi-Fi Solution Architecture

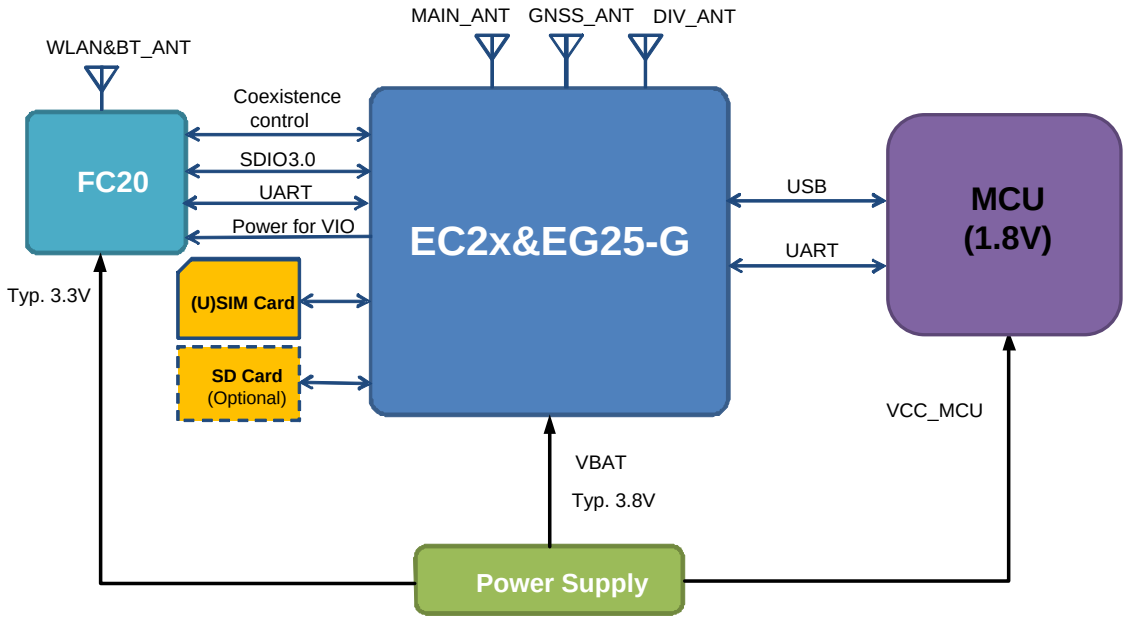

Figure 2: Wi-Fi Solution Architecture

1. EC2x&EG25-G modules communicate with FC20 through SDIO 3.0 interface with maximum data rate up to 200Mb/s.
2. The communication between MCU and EC2x&EG25-G modules can be realized through USB or UART.
3. If the MCU voltage level is not 1.8V, a voltage level translation circuit should be added between the module and the MCU.

2 Wi-Fi Related AT Commands

Table 2: Types of AT Commands and Responses

Test Command	**AT+<*x*>=?**	This command returns the list of parameters and value ranges set by the corresponding Write Command or internal processes.
Read Command	**AT+<*x*>?**	This command returns the currently set value of the parameter or parameters.
Write Command	**AT+<*x*>=<…>**	This command sets the user-definable parameter values.
Execution Command	**AT+<*x*>**	This command reads non-variable parameters affected by internal processes in the module.

NOTES

1. **<…>**: Parameter name. Angle brackets do not appear on the command line. The parameter value indicated by "_" is the default one.
2. **[…]**: Optional parameter. Square brackets do not appear on the command line. When an optional parameter is omitted, the default value will be used unless otherwise specified.

2.1. AT+QWIFI Enable/Disable Wi-Fi Function

This command is used to enable or disable Wi-Fi function.

AT+QWIFI Enable/Disable Wi-Fi Function	
Test Command **AT+QWIFI=?**	Response **+QWIFI: (**list of supported **<value>**s**)** **OK**
Read Command **AT+QWIFI?**	Response **+QWIFI: <value>** **OK**
Write Command **AT+QWIFI=<value>**	Response **OK**

	Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<value>	Integer type. The current state of Wi-Fi. 0 Wi-Fi is disabled 1 Wi-Fi is enabled

Example

```
AT+QWIFI?
+QWIFI: 0                    //Wi-Fi function is currently disabled.

OK
AT+QWIFI=1                   //Enable Wi-Fi function.
OK
```

2.2. AT+QWSSIDHEX Set SSID Encoding

This command is used to set the SSID encoding.

AT+QWSSIDHEX Set SSID Encoding	
Test Command **AT+QWSSIDHEX=?**	Response **+QWSSIDHEX: (**list of supported **<encode>**s**)** **OK**
Read Command **AT+QWSSIDHEX?**	Response **+QWSSIDHEX: <encode>** **OK**
Write Command **AT+QWSSIDHEX=<encode>**	Response **OK** Or **ERROR**
Maximum Response Time	30s

Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<encode>	Integer type. Set whether the **<SSID>** of **AT+QWSSID** command is in HEX format or string format. **<SSID>** is saved separately. Please refer to AT command **AT+QWSSID** in ***Chapter 2.3***. 0 Parameter **<SSID>** of **AT+QWSSID** command is a string 1 Parameter **<SSID>** of **AT+QWSSID** command is a HEX number

Example

```
AT+QWSSIDHEX?
+QWSSIDHEX: 0                          //The current SSID is in string format.

OK
AT+QWSSID?
+QWSSID: QSoftAP                       //The current SSID is QSoftAP.

OK
AT+QWSSIDHEX=1                         //Set SSID to HEX format.
OK
AT+QWSSID?
+QWSSID: 5175656374656c2d57494649      //The current SSID is Quectel-WIFI for ASCII encoding.

OK
```

2.3. AT+QWSSID Set SSID

This command is used to set Wi-Fi SSID.

AT+QWSSID Set SSID	
Test Command **AT+QWSSID=?**	Response **+QWSSID: <SSID>** **OK**
Read Command **AT+QWSSID?**	Response **+QWSSID: <SSID>** **OK**

Write Command **AT+QWSSID=<SSID>**	Response **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<SSID>	When **AT+QWSSIDHEX=0**: ASCII string with length not greater than 32 bytes, and the default value is QSoftAP. When **AT+QWSSIDHEX=1**: String type. HEX digits. The length of raw data is no more than 32 bytes after coding (such as GBK, UTF-8, etc.). This is mainly used to set SSID in Chinese.

Example

```
AT+QWSSIDHEX?
+QWSSIDHEX: 0

OK
AT+QWSSID?
+QWSSID: QSoftAP              //The current SSID is QSoftAP.

OK
AT+QWSSID=EC25_WIFI           //Set new SSID to EC25_WIFI.
OK
```

2.4. AT+QWBCAST Enable/Disable Broadcast

This command is used to enable or disable the broadcast.

AT+QWBCAST Enable/Disable Broadcast	
Test Command **AT+QWBCAST=?**	Response **+QWBCAST: (**list of supported **<broadcast>**s**)** **OK**
Read Command **AT+QWBCAST?**	Response **+QWBCAST: <broadcast>**

	OK
Write Command **AT+QWBCAST=<broadcast>**	Response **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<broadcast>	Integer type. Enable or disable broadcast. 0 Disable broadcast 1 Enable broadcast

Example

```
AT+QWBCAST?
+QWBCAST: 1                    //The broadcast is enabled.

OK
AT+QWBCAST=0                   //The broadcast is disabled.
OK
```

2.5. AT+QWAUTH Set Network Authorization Type, Encryption Mode and Password

This command is used to set network authorization type, encryption mode and password.

AT+QWAUTH Set Network Authorization Type, Encryption Mode and Password	
Test Command **AT+QWAUTH=?**	Response **+QWAUTH: (**list of supported **<auth>**s**)** **OK**
Read Command **AT+QWAUTH?**	Response **+QWAUTH: <auth>[,<encrypt>,<password>]** **OK**

Write Command **AT+QWAUTH=<auth>,<encrypt>[,<password>]**	Response **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<auth>	Integer type. Authorization type. 1 Open 3 WPA 4 WPA2 5 WPA/WPA2
<encrypt>	Integer type. Encryption mode. 0 No encryption 2 TKIP 3 AES 4 TKIP-AES
<password>	String type. Password string.

NOTE

The default network authorization mode is WPA2, encryption mode is AES and password is 1234567890. The setting of these parameters should comply with the following criteria:

1. If **<auth>** is 1, **<encrypt>** must be 0.
2. If **<auth>** ≥ 3, **<encrypt>** must ≥ 2.
3. If **<encrypt>**=0, **<password>** is null.
4. If **<encrypt>** ≥2, **<password>** needs 8-63 ASCII characters or 64 HEX number and **""** needs to be added to ASCII characters.

Example

```
AT+QWAUTH?
+QWAUTH: 4,3,"1234567890"

OK
AT+QWAUTH=1,0                  //Set authorization type as open and encryption mode as null.
OK
AT+QWAUTH=5,4,"12345678"       //Set authorization type as WPA/WPA2 and encryption
                                 mode as TIKP-AES.
```

OK

2.6. AT+QWMOCH Set Frequency Mode and Channel Selection of 802.11 Network

This command is used to set the frequency mode and channel of 802.11 network.

AT+QWMOCH Set Frequency Mode and Channel Selection of 802.11 Network	
Test Command **AT+QWMOCH=?**	Response **+QWMOCH: (**range of supported **<mode>**s**),(**list of supported **<channel>**s**)** **OK**
Read Command **AT+QWMOCH?**	Response **+QWMOCH: <mode>,<channel>** **OK**
Write Command **AT+QWMOCH=<mode>,<channel>**	Response **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<mode>	Integer type. 802.11 network frequency mode.		
	1	a/n	5G HT20 mode
	2	b	2.4G mode
	3	b/g	2.4G mode
	4	b/g/n	2.4G mode
	5	b/g/n	5G HT40 mode
	6	a/n	5G HT40 mode
	7	a	5G mode
	8	g	5G mode
	9	a/n	5G HT20 mode
	10	ac	5G VHT40 mode
	11	ac	5G VHT80 mode

	12	n	2.4G HT20 mode
	13	n	2.4G HT40 mode
	14	n	5G HT20 mode
	15	n	5G HT40 mode
<channel>	Integer type. 802.11 network channel selection.		
	0		Automatic selection
	1-13		2.4G channel
	36/40/44/48/52/56/60/64/100/104/108/112/116/120/124/128/132/136/140/144/149/153/157/161/165		5G channel

NOTE

<mode> and **<channel>** should meet the following requirements:

1) If **<mode>** is 1/6/7/9/10/11/14/15, **<channel>** must be set to 0 or 36/40/44/48/52/56/60/64/100/104/108/112/116/120/124/128/132/136/140/144/149/153/157/161/165, and the client device must support 5G mode.
2) If **<mode>** is 2/3/4/5/8/12/13, **<channel>** must be set to 0-13.

Example

```
AT+QWMOCH?
+QWMOCH: 4,0                    //Current frequency mode is 2.4G b/g/n, and the channel is
                                  automatically selected.

OK
AT+QWMOCH=3,1                   //Set frequency mode to 2.4G b/g, channel 1.
OK
```

2.7. AT+QWISO Enable/Disable Isolation Among Clients Connected to AP

This command is used to enable or disable isolation among clients connected to AP.

AT+QWISO Enable/Disable Isolation Among Clients Connected to AP	
Test Command **AT+QWISO=?**	Response **+QWISO: (**list of supported **<isolation>**s**)** **OK**
Read Command **AT+QWISO?**	Response **+QWISO: <isolation>**

	OK
Write Command **AT+QWISO=<isolation>**	Response **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<isolation>	Integer type. Status of isolation among clients connected to AP. 0 Disable isolation status 1 Enable isolation status

Example

```
AT+QWISO?
+QWISO: 1                    //Currently isolation is enabled.

OK
AT+QWISO=0                   //Disable isolation.
OK
```

2.8. AT+QWCLICNT Query the Number of Wi-Fi Clients

This command is used to query the number of clients connected to AP.

AT+QWCLICNT Query the Number of Wi-Fi Clients	
Read Command **AT+QWCLICNT?**	Response **+QWCLICNT: (**range of supported **<count>**s**)** **OK**
Characteristics	/

Parameter

<count>	The number of clients connected to AP. Default: 16. Range: 1-16.

Example

```
AT+QWCLICNT?
+QWCLICNT: 16                    //Currently 16 clients are connected to AP.

OK
```

2.9. AT+QWRSTD Restore Default Settings

This command is used to restore Wi-Fi to default settings.

AT+QWRSTD Restore Default Settings	
Write Command **AT+QWRSTD**	Response **OK**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Example

```
AT+QWRSTD          //Restore Wi-Fi to default settings.
OK
```

2.10. AT+QWIFICFG Extended Configuration Settings

The command is used to query and configure various settings of Wi-Fi.

AT+QWIFICFG Extended Configuration Settings	
Test Command **AT+QWIFICFG=?**	Response **…** **+QWIFICFG: "workmode",(**range of supported **<work_mode>**s**)** **+QWIFICFG: "ssid",(**list of supported **<index>**s**),<SSID>** **+QWIFICFG: "ssidhide",(**list of supported **<index>**s**),(**list of supported **<SSID_hide>**s**)** **+QWIFICFG: "maxsta",(**list of supported **<index>**s**),(**range of supported **<maxsta>**s**)** **+QWIFICFG: "channel",(**list of supported **<index>**s**),(**list of supported **<channel>**s**)**

	+QWIFICFG: "mode",(list of supported **<index>s),(**list of supported **<mode>s)** **+QWIFICFG: "bandwidth",(**list of supported **<index>s),(**range of supported **<bandwidth>s)** **+QWIFICFG: "auth",(**list of supported **<index>s),(**list of supported **<auth>s)[,(**list of supported **<encrypt>s),<password>]** **+QWIFICFG: "macacl",(**list of supported **<index>s),(**range of supported **<command>s,(**range of supported **<rule>s)[,<MAC>]** **+QWIFICFG: "cc",<country_code>** **+QWIFICFG: "stainfo"** **+QWIFICFG: "scan"[,(**list of supported **<async>s)]** **+QWIFICFG: "scanresult"** **+QWIFICFG: "stastatus"** **…** **OK**

2.10.1. AT+QWIFICFG="workmode" Set Work Mode

This command is used to set Wi-Fi work mode and Wi-Fi is required to be disabled.

AT+QWIFICFG="workmode" Set Work Mode	
Write Command **AT+QWIFICFG="workmode"[,<work_mode>]**	Response If **<work_mode>** is omitted, current configuration is returned: **+QWIFICFG: "workmode",<work_mode>** **OK** If **<work_mode>** is specified, configure the Wi-Fi work mode: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<work_mode>	Integer type. Work mode of Wi-Fi. 0 AP0 mode 1 STA mode

2	AP0 and STA mode concurrency
3	AP0 and AP1 mode concurrency

2.10.2. AT+QWIFICFG="ssid" Set SSID

This command is used to set Wi-Fi SSID.

AT+QWIFICFG="ssid" Set SSID	
Write Command **AT+QWIFICFG="ssid",<index>[,<SSID>]**	Response If **<SSID>** is omitted, current configuration is returned: **+QWIFICFG: "ssid",<index>,<SSID>** **OK** If **<SSID>** is specified, configure the Wi-Fi SSID: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index. 0 AP0 1 AP1 2 STA
<SSID>	String type. ASCII string with length not greater than 32 bytes, and the default value is QSoftAP.

2.10.3. AT+QWIFICFG="ssidhide" Enable/Disable the Hiding of AP SSID

This command is used to enable or disable to hide SSID of access point.

AT+QWIFICFG="ssidhide" Enable/Disable the Hiding of AP SSID	
Write Command **AT+QWIFICFG="ssidhide",<index>[,<SSID_hide>]**	Response If **<SSID_hide>** is omitted, current configuration is returned: **+QWIFICFG: "ssidhide",<index>,<SSID_hide>** **OK** If parameter **<SSID_hide>** is specified, enable or disable the

	hiding of AP SSID: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index. 0 Primary AP 1 Guest AP
<SSID_hide>	Integer type. Enable or disable the hiding of SSID. 0 Disable the hiding of SSID 1 Enable the hiding of SSID

2.10.4. AT+QWIFICFG="maxsta" Set Maximum Number of Stations Allowed

This command is used to set maximum number of stations allowed in AP mode.

AT+QWIFICFG="maxsta" Set Maximum Number of Stations Allowed	
Write Command **AT+QWIFICFG="maxsta",<index>[,<maxsta>]**	Response If **<maxsta>** is omitted, current configuration is returned: **+QWIFICFG: "maxsta",<index>,<maxsta>** **OK** If **<maxsta>** is specified, configure maximum number of stations allowed in AP mode: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index. 0 Primary AP

	1 Guest AP
<maxsta>	Integer type. Maximum number of stations allowed in AP mode. Default: 16. Range: 1-16.

Example

```
AT+QWIFICFG="maxsta",0
+QWIFICFG: "maxsta",0,16          //The current maximum number of stations is 16.

OK
AT+QWIFICFG="maxsta",0,10         //Set Primary AP's maximum number of stations to 10.
OK
```

2.10.5. AT+QWIFICFG="channel" Set Channel

This command is used to set channel of Wi-Fi AP mode.

AT+QWIFICFG="channel" Set Channel	
Write Command **AT+QWIFICFG="channel",<index>[,<channel>]**	Response If **<channel>** is omitted, return current configuration: **+QWIFICFG: "channel",<index>,<channel>** **OK** If **<channel>** is specified, configure the AP mode channel: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index 0 Primary AP 1 Guest AP
<channel>	Integer type. Channel lists of each country code, which are different. Range: 0-13,36,4 0, 44,48,52,56,60,64,100,104,108,112,116,120,124,128,132,136,140,144,149,153,157, 161,165.

2.10.6. AT+QWIFICFG="mode" Set Frequency Mode

This command is used to set frequency mode of AP mode.

AT+QWIFICFG="mode" Set Frequency Mode	
Write Command **AT+QWIFICFG="mode",<index>[,<mode>]**	Response If **<mode>** is omitted, current configuration is returned: **+QWIFICFG: "mode",<index>,<mode>** **OK** If parameter **<mode>** is specified, configure the AP frequency mode: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index. 0 Primary AP 1 Guest AP
<mode>	Integer type. The frequency mode of AP mode. 0 802.11a 1 802.11a/n 2 802.11b 3 802.11b/g 4 802.11b/g/n 5 802.11ac

2.10.7. AT+QWIFICFG="bandwidth" Set Bandwidth

This command is used to set bandwidth of AP mode.

AT+QWIFICFG="bandwidth" Set Bandwidth	
Write Command **AT+QWIFICFG="bandwidth",<index>[,<bandwidth>]**	Response If **<bandwidth>** is omitted, current configuration is returned: **+QWIFICFG: "bandwidth",<index>,<bandwidth>** **OK**

	If **<bandwidth>** is specified, configure the bandwidth of the AP mode: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	The serial number of Wi-Fi index. 0 Primary AP 1 Guest AP
<bandwidth>	The bandwidth of AP mode. 0 20MHz 1 40MHz 2 80MHz, only 802.11ac frequency mode is supported.

2.10.8. AT+QWIFICFG="auth" Set Authorization Type, Encryption Mode and Password

This command is used to set authorization type, encryption mode and password.

AT+QWIFICFG="auth" Set Authorization Type, Encryption Mode and Password	
Write Command **AT+QWIFICFG="auth",<index>[,<auth>[,<encrypt>,<password>]]**	Response If **<auth>**, **<encrypt>**, **<password>** are omitted, current configuration is returned: **+QWIFICFG: "auth",<index>,<auth>[,<encrypt>,<password>]** **OK** If **<auth>** is specified, When **<auth>** is 0, **<encrypt>** and **<password>** should be omitted, then configure the authorization type: **OK** Or **ERROR** When **<auth>** is not 0, **<encrypt>** and **<password>** should be specified, then configure authorization type, encryption

	mode and password: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index. 0 Primary AP 1 Guest AP 2 STA
<auth>	Integer type. Authorization type. 0 Open system authentication 2 WPA personal authentication 3 WPA2 personal authentication 4 WPA/WPA2 personal authentication
<encrypt>	Integer type. Encryption mode. This parameter is only available when **<auth>** is not 0. 0 TKIP 1 AES 2 TKIP and AES
<password>	String type. Password of WPA and WPA2 personal authentication. This parameter is only available when **<auth>** is not 0.

2.10.9. AT+QWIFICFG="macacl" Set MAC Address Filter List

This command is used to set MAC address filter list of AP mode.

AT+QWIFICFG="macacl" Set MAC Address Filter List	
Write Command **AT+QWIFICFG="macacl",<index>,<command>[,<rule>[,<MAC>]]**	Response If **<rule>** and **<MAC>** are omitted, current configuration is returned: **+QWIFICFG: "macacl",<index>,<command>,<rule>,<MAC>** **OK** If **<rule>** and **<MAC>** are specified, set MAC address filter list: **OK** Or

	ERROR
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<index>	Integer type. The serial number of Wi-Fi index. 0 Primary AP 1 Guest AP
<command>	Integer type. Operation options of the AT command. 0 Set and get rule of station MAC address-based authentication 1 Add station MAC address 2 Delete station MAC address 3 Get station MAC address
<rule>	Integer type. The rule of station MAC address-based authentication. 0 Disabled 1 Blacklist 2 Whitelist
<MAC>	String type. The station MAC address.

NOTES

1. MAC address filter will be disabled when **<rule>** is 0 in which case **<MAC>** should be omitted.
2. Please firstly execute **AT+QWIFICFG="macacl",<index>,<command>,<rule>** to set the rule of station MAC address-based authentication to blacklist/whitelist, and then execute **AT+QWIFICFG="macacl",<index>,<command>,<rule>,<MAC>** to add/delete the MAC address.
3. Either blacklist or whitelist should exist because they shall not exist at the same time.

2.10.10. AT+QWIFICFG="cc" Set Country Code

This command is used to set Wi-Fi country code. The country code is compliant with *ISO 3166 alpha-2*.

AT+QWIFICFG="cc" Set Country Code	
Write Command **AT+QWIFICFG="cc"[,<country_code>]**	Response If **<country_code>** is omitted, current configuration is returned: **+QWIFICFG: "cc",<country_code>** **OK** If **<country_code>** is specified, configure the Wi-Fi country

	code: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	The command takes effect immediately. The configuration will be saved automatically.

Parameter

<country_code>	String type. The country code of Wi-Fi. The default value is CN.

Example

```
AT+QWIFICFG="cc"
+QWIFICFG: "cc","CN"                    //The current country code is CN.

OK
AT+QWIFICFG="cc","JP"                   //Set country code to JP.
OK
```

2.10.11. AT+QWIFICFG="stainfo" Get Stations Information

This command is used to get stations information of AP mode.

AT+QWIFICFG="stainfo" Get Stations Information	
Write Command **AT+QWIFICFG="stainfo"**	Response **…** **+QWIFICFG: "auth",<cnt>,<MAC>,<IPv4_addr>,<IPv6_addr>,<host_name>** **…** **OK** Or **ERROR**
Characteristics	/

Parameter

<cnt>	Integer type. The station serial number.
<MAC>	String type. The station mac address.

<IPv4_addr>	String type. The station IPv4 address.
<IPv6_addr>	String type. The station IPv6 address.
<host_name>	String type. The station host name.

2.10.12. AT+QWIFICFG="scan" Scan Wi-Fi Hotspot Information

This command is used to scan Wi-Fi hotspot information for working in STA mode.

AT+QWIFICFG="scan" Scan Wi-Fi Hotspot Information	
Write Command **AT+QWIFICFG="scan"[,<async>]**	Response If **<async>** is omitted or set to 0, current information is returned: … **+QWIFICFG: "scan",<MAC>,<SSID>,<signal>,<auth>** … **OK** If **<async>** is set to 1: **OK** Or **ERROR**
Maximum Response Time	30s
Characteristics	/

Parameter

<async>	Integer type. The way of returning hotspots information. 0 Return hotspots information synchronously. 1 Return hotspots information asynchronously. Hotspots information will be returned via a URC after executing **AT+QWIFICFG="scanresult"**.
<MAC>	String type. The hotspot MAC address.
<SSID>	String type. The hotspot SSID name.
<signal>	Integer type. The hotspot signal quality. Range: -95~-1. The smaller the value is, the worse the signal quality will be.
<auth>	Integer type. Authorization type. 0 Open system authentication 2 WPA personal authentication 3 WPA2 personal authentication 4 WPA/WPA2 personal authentication

2.10.13. AT+QWIFICFG="scanresult" Get Wi-Fi Scanning Hotspot Information Result

This command is used to get Wi-Fi scanning hotspot information result.

AT+QWIFICFG="scanresult" Get Wi-Fi Scanning Hotspot Information Result	
Write Command **AT+QWIFICFG="scanresult"**	Response **…** **+QWIFICFG: "scan",<MAC>,<SSID>,<signal>,<auth>** **…** **OK**
Maximum Response Time	30s
Characteristics	/

Parameter

<MAC>	String type. The hotspot MAC address.
<SSID>	String type. The hotspot SSID name.
<signal>	Integer type. The hotspot signal quality. Range: -95~-1. The smaller the value is, the worse the signal quality will be.
<auth>	Integer type. Authorization type. 0 Open system authentication 2 WPA personal authentication 3 WPA2 personal authentication 4 WPA/WPA2 personal authentication

2.10.14. AT+QWIFICFG="stastatus" Get Connection Information of STA Mode

This command is used to get connection information of STA mode.

AT+QWIFICFG="statatus" Get Connection Information of STA Mode	
Write Command **AT+QWIFICFG="stastatus"**	Response **+QWIFICFG: "stastatus",<state>,<SSID>,<MAC>,<channel>,<signal>** **OK** Or **ERROR**
Characteristics	/

Parameter

<state>	Integer type. STA mode connection status. Range: 0-1. When it is 0, **<SSID>**, **<MAC>**, **<channel>** and **<signal>** should be omitted. 0 Disconnected. 1 Connected.
<SSID>	String type. The access hotspot SSID name.
<MAC>	String type. The access hotspot MAC address.
<channel>	Integer type. The access hotspot channel. Channel lists of each country code, which are different. Range: 0-13,36,40,44,48,52,56,60,64,100,104,108,112,116,120, 124,128,132,136,140,144,149,153,157,161,165. Channel list varies from different country codes.
<signal>	Integer type. The access hotspot signal quality. Range: -95~-1.

3 Wi-Fi Related URC

3.1. +QWIFIND URC of Client Connection Status

After Wi-Fi is enabled (**AT+QWIFI=1**), if a client is connected or disconnected to AP, the URC will be reported to indicate the MAC address of the client.

+QWIFIND URC of Client Connection Status	
+QWIFIND: <connect>,<MAC>	

Parameter

<connect>	Integer type. Client connection/disconnection status. 0 Client is disconnected to AP 1 Client is connected to AP
<MAC>	String type. MAC address of the client. Format: HEX number, such as: "0A:0B:0C:0D:0E:0F"

Example

+QWIFIND: 1,"0A:0B:0C:0D:0E:0F"	//The client of which MAC address is “0A:0B:0C:0D:0E:0F” has been connected to AP.
+QWIFIND: 0,"0A:0B:0C:0D:0E:0F"	//The client of which MAC address is “0A:0B:0C:0D:0E:0F” has been disconnected.

3.2. +QWIFICFG="stastatus" URC of STA Connection Status

After Wi-Fi is enabled (**AT+QWIFI=1**), if STA is connected or disconnected to AP, a URC will be reported to indicate the status and AP information automatically.

+QWIFICFG="stastatus" URC of STA Connection Status	
+QWIFICFG:"stastatus",<state>[,<SSID>]	When the Wi-Fi STA status is changed, this URC will be reported.

Parameter

<state>	Integer type. STA status. 0 Disconnected. 1 Connected.
<SSID>	String type. The access hotspot SSID name. When **<state>**=0, **<SSID>** should be omitted.

3.3. +QWIFCFG="scandone" URC of Finishing STA Scanning

After executing **AT+QWIFICFG="scan",1**, if Wi-Fi STA scanning is finished, a URC will be reported.

+QWIFCFG="scandone" URC of Finishing STA Scan	
+QWIFICFG: "scandone",<state>	When the Wi-Fi STA scanning is finished, this URC will be reported.

Parameter

<state>	Integer type. Scanning status. 1 Scanning finished

4 Examples

4.1. Single AP Mode

```
AT+QWIFICFG="workmode",0                    //Set work mode to single AP (AP0)
OK
AT+QWIFICFG="ssid",0,"AP-MODE-TEST"         //Set the SSID of AP0 to AP-MODE-TEST
OK
AT+QWIFICFG="channel",0,5                   //Set the channel of AP0 to 5
OK
AT+QWIFICFG="mode",0,4                      //Set the frequency mode of AP0 to 802.11b/g/n
OK
AT+QWIFICFG="auth",0,3,2,"1234567890"       //Set the authorization type of AP0 to WPA2 personal
                                            authentication, encryption mode to TKIP and AES and
                                            password to "1234567890"
OK
AT+QWIFI=1                                  //Enable Wi-Fi
OK
```

4.2. Single STA Mode

```
AT+QWIFICFG="workmode",1                    //Set work mode to single STA
OK

AT+QWIFICFG="ssid",2,QSoftAP                //Set the SSID of STA to QSoftAP
OK

AT+QWIFICFG="auth",2,0                      //Set the authorization type of STA to open system
                                              authentication.
OK
AT+QWIFI=1                                  //Enable Wi-Fi

OK
```

4.3. AP0+AP1 Mode

```
AT+QWIFICFG="workmode",3                    //Set work mode to AP0+AP1
OK

AT+QWIFICFG="ssid",0,QSoftAP-2.4G           //Set SSID of AP0 to QSoftAP-2.4G
OK

AT+QWIFICFG="ssid",1,QSoftAP-5G             //Set SSID of AP1 QSoftAP-5G
OK

AT+QWIFI=1                                  //Enable Wi-Fi
OK
```

4.4. AP+STA Mode

```
AT+QWIFICFG="workmode",2                    //Set work mode to AP+STA mode
OK
AT+QWIFICFG="ssid",0,"AP-MODE-TEST"         //Set SSID of AP0 to AP-MODE-TEST
OK

AT+QWIFICFG="ssid",2,QSoftAP                //Set SSID of STA to QSoftAP

OK
AT+QWIFICFG="auth",2,4,2,"1234567890"       //Set Authorization type of STA to WPA/WPA2 personal
                                              authentication, encryption mode to TKIP and AES and
                                              password to "1234567890".
OK
AT+QWIFI=1                                  //Enable Wi-Fi
OK
```

4.5. Scan the Hotspots Nearby

```
AT +QWIFICFG="workmode",1                   //Set work mode to single STA.
OK
AT+QWIFI=1                                  //Enable Wi-Fi.
OK
AT+QWIFICFG="scan",0                        //Set Wi-Fi to scan and return hotspots information
                                              synchronously.
```

```
+QWIFICFG: "scan","01:02:03:04:05:06,"Quectel_WiFi_Test",-34,4
                                        //Return MAC address, SSID, signal, authentication
                                        type of hotspot nearby.
....

OK
AT+QWIFICFG="scan",1                    //Set Wi-Fi to scan and asynchronous return hotspots
                                          information.
OK
+QWIFICFG: "scandone",1                 //If STA is scanned, the URC will be reported.

AT+QWIFICFG="scanresult"                //Get nearby hotspots information.

+QWIFICFG: "scan","01:02:03:04:05:06,"Quectel_WiFi_Test",-34,4
                                        //Return MAC address, SSID, signal, authentication type of
                                          hotspot nearby.
....

OK
```

5 Appendix A References

Table 3: Related Documents

Abbreviation	Description
AES	Advanced Encryption Standard
AP	Access Point
ASCII	American Standard Code for Information Interchange
GBK	Chinese Internal Code Specification
GNSS	Global Navigation Satellite System
HEX	Hexadecimal
IoT	Internet of Things
IP	Internet Protocol
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
LTE	Long Term Evolution
MAC	Media Access Control
MCU	Microcontroller Unit
NMEA	National Marine Electronics Association
SSID	Service Set Identifier
STA	Station
TKIP	Temporal Key Integrity Protocol
UART	Universal Asynchronous Receiver/Transmitter
URC	Unsolicited Result Code

USB	Universal Serial Bus
UTF	Unicode Transformation Format
WEP	Wired Equivalent Privacy
WLAN	Wireless Local Area Network
WPA	Wi-Fi Protected Access
WWAN	Wireless Wide Area Network